

Application No. 10/707,252
Docket No. 13DV-14265
Amendment dated January 6, 2005
Reply to Office Action of October 6, 2004

REMARKS

In the Office Action, the Examiner reviewed claims 1-20 of the above-identified US Patent Application, with the result that claims 1-12 were rejected under 35 USC §102 or §103, and claims 13-20 were rejected under 35 USC §112, second paragraph, but otherwise deemed to recite allowable subject matter. In response, Applicant has amended the specification and claims as set forth above. More particularly:

The specification has been amended at paragraph [0015] to insert the reference number "30," which identifies the "grain structure" as shown in Figure 2.

The specification has been amended at paragraph [0019] to address what appears to be an inconsistency, namely, though paragraph [0019] discloses that a "suitable composition for the inner region 32 is, by weight, about 20% to 30% aluminum," the last sentence of paragraph [0019] states "the aluminum content of the inner region 32 is preferably limited to not more than about 18 weight percent." As clarification, the last sentence in paragraph [0019] has been rewritten to state that "it is foreseeable that the aluminum content of the inner region 32 could be less than 18 weight percent."

Independent claim 1 has been amended to specify "the inner and outer regions being deposited from first and second coating sources, respectively, the first coating source having a higher chromium content than the second coating source." Support for

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this amendment can be found in Applicant's specification at paragraph [0020].

Dependent claims 4 and 17 have been amended to recite that the coating system further comprises a diffusion zone between the substrate and the inner region of the overlay coating, and that the diffusion zone contains elements that have interdiffused from the substrate and the overlay coating. Support for this amendment can be found in Applicant's specification at paragraph [0020].

Dependent claims 5 and 6 have been amended to depend from claim 4.

Applicant believes that the above amendments do not present new matter. Favorable reconsideration and allowance of claims 1-20 are respectfully requested in view of the above amendments and the following remarks.

Rejection under 35 USC §112, Second Paragraph

Claims 13-20 were rejected under 35 USC §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicant regards as his invention. Applicant respectfully requests favorable reconsideration in view of the following comments.

The Examiner noted claim 13 as reciting "the inner region consisting of, by weight, . . . about 5% to about 20% chromium, . . . the outer region consisting of, by weight, about 1% to about 5% chromium, . . . the inner region containing more chromium than the outer region," and questioned "[i]f . . . the inner region is to contain

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more chromium than the outer region, should there be any overlap for the possibilities of amounts?"

Applicant believes that requirement in claim 13 that "the inner region contain[s] more chromium than the outer region" dictates where, within the recited chromium ranges, the actual chromium contents may be for the inner and outer regions 32 and 34 of a given overlay coating 24. Specifically, if the inner region 32 contains the minimum amount of chromium within its recited 5-20% range (i.e., about 5% chromium), then the additional limitation that "the inner region contain[s] more chromium than the outer region" dictates that the outer region 34 must contain less than the maximum amount of chromium allowed by its recited range of 1-5% (i.e., less than 5% chromium). Similarly, if the outer region 34 contains the maximum amount of chromium within its recited range of 1-5% (i.e., about 5% chromium), then the inner region 32 must contain more than the minimum amount of chromium allowed by its recited range of 5-20% (i.e., more than 5% chromium).

The above is consistent with the scope of the invention that permits the inner region 32 to contain as little as about 5% chromium and the outer region 34 to contain as much as about 5% chromium. Therefore, Applicant respectfully requests reconsideration of the rejection under 35 USC §112, second paragraph.

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Rejection under 35 USC §102

Independent claim 1 and its dependent claims 2 and 7-12 were rejected under 35 USC §102(e) as being anticipated by U.S. Patent No. 6,669,989 to Movchan et al. (Movchan). Applicant respectfully requests reconsideration of this rejection in view of the amendments presented above as well as the following comments.

Movchan is directed to a process of depositing multiple-layered coating systems in a single deposition process. See, for example, the Abstract of Movchan. As evident from Figures 1 through 11 of Movchan, the deposition process employs an ingot 10 containing inserts of one or more different materials, which causes the composition being deposited to change over time, with considerable variation in composition existing within each layer. For example, Figures 2a and 2b of Movchan disclose a coating system deposited from an ingot formed of yttria-stabilized zirconia (YSZ) and containing an aluminum insert, from which a "second bond coat" and then a ceramic outer coating are deposited. The second bond coat contains aluminum from the insert and nickel, chromium, and cobalt (not shown) that diffuse from an MCrAlY bond coat on which the second bond coat is deposited. Because the chromium content within the second bond coat is entirely the result of diffusion from the MCrAlY bond coat, its level within the second bond coat is greatest at the interface with the MCrAlY bond coat and lowest at the interface with the YSZ coating.

Similarly, Figures 3a and 3b of Movchan disclose a coating system deposited

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from a YSZ ingot containing an nickel-aluminum insert, from which a bond coat and then a YSZ coating are deposited. The insert contains, by weight, 67% nickel and 33% aluminum, which is approximately the chemistry of β NiAl intermetallic. As a result, the bond coat contains nickel and aluminum from the insert, but also contains chromium and cobalt that have diffused from the underlying superalloy substrate, "Rene #5" (René N5). Again, because the chromium content within the bond coat is entirely the result of diffusion, its level within the bond coat is greatest at the interface with the substrate and lowest at the interface with the YSZ coating.

Another example disclosed in Movchan is depicted in Figures 5a and 5b, which represent, respectively, a YSZ ingot and a coating system deposited from the ingot. The ingot contains an nickel-chromium-aluminum ("NiCrAl") insert, and is used to deposit a "second bond coat" and then a YSZ coating on a MCrAlY bond coat. The insert contains, by weight, 57% nickel, 15% chromium, and 33% aluminum. Even though the NiCrAl insert is the only source from which nickel, chromium, and aluminum are deposited onto the MCrAlY bond coat, interdiffusion with the MCrAlY bond coat causes the chromium content within the second bond coat to vary drastically, with its highest level at the interface with the MCrAlY bond coat and its lowest at the interface with the YSZ coating.

It would appear logical to presume that the widely varying chromium contents in the bond coats deposited from Movchan's ingots is the result of the process

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employed by Movchan, including the use of a single insert from which the bond coats are deposited and the reliance on interdiffusion to introduce other possibly desired constituents (e.g., nickel, chromium, and cobalt).

In contrast, Applicant's claim 1 requires

A coating system on a substrate, the coating system comprising a beta-phase NiAl intermetallic overlay coating comprising inner and outer regions, the inner and outer regions being deposited from first and second coating sources, respectively, the first coating source having a higher chromium content than the second coating source so that the inner region contains more chromium than the outer region.

According to MPEP §2163.07(a):

By disclosing in a patent application a device that inherently...has a property, . . . a patent application necessarily discloses that . . . advantage, even though it says nothing explicit concerning it.

Applicant believes that, because claim 1 requires inner and outer regions deposited from different coating sources and the source for the inner region has a higher chromium content, it is inherent that the inner and outer regions have different and more uniform chromium contents than any of the coatings disclosed by Movchan, whose chromium contents are either obtained entirely by diffusion (e.g., Figures 2b and 3b) or are greatly altered by diffusion (e.g., Figure 5b). Therefore, Applicant believes that Movchan does not disclose "each and every element as set forth in the claim . . . , either expressly or

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inherently" (MPEP §2131), and therefore claim 1 is not anticipated by Movchan.

Dependent claim 10 as filed requires that "the inner and outer regions are discreet layers of the overlay coating" (emphasis added). Movchan's continuous deposition process appears to make this type of coating structure impossible.

In view of the above, Applicant respectfully requests withdrawal of the rejection under 35 USC §102.

Rejection under 35 USC §103

Dependent claims 3-6 were rejected under 35 USC §103(a) as being unpatentable over Movchan in view of U.S. Patent No. 6,291,084 to Darolia et al. (Darolia), on the basis that Darolia discloses NiCrAlZr compositions encompassing the compositions recited in claims 3-6. However, in view of Applicant's above remarks concerning Movchan, Applicant believes that Darolia cannot be said to supplement the teachings of Movchan in order to arrive at Applicant's invention. At best, modifying Movchan's continuous deposition process to employ an insert formed of Darolia's NiCrAlZr composition would still result in a bond coat whose composition varies widely through its thickness as a result of considerable diffusion of chromium, cobalt, etc., from the underlying coating/substrate into the bond coat. Therefore, any attempt to arrive at Applicant's invention based on the combination of Movchan and Darolia would require modifying Movchan's process in a manner that is not achieved or suggested by

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the combination.

Furthermore, amended claim 4 requires

a limited diffusion zone between the substrate and the inner region of the overlay coating, the diffusion zone containing elements that have interdiffused from the substrate and the overlay coating.

As such, claim 4 requires the presence of a diffusion zone that is in addition to and compositionally different from the inner and outer regions of the overlay coating.

Therefore, Applicant believes that the coating recited in claim 4 is also distinguishable from the bond coats disclosed by Movchan, in that effectively the entire thickness of each of Movchan's bond coats constitutes a diffusion zone, as evidenced by the considerable diffusion of nickel, chromium, cobalt, and/or aluminum into or out of the bond coats, which results in the widely varying levels of these elements within the bond coats.

Regarding claims 5 and 6 (which now depend from claim 4), because of the continuous deposition process employed by Movchan, it does not appear possible that Movchan's bond coats can ever "consist of" nickel, aluminum, chromium, zirconium, and incidental impurities."

Applicant therefore respectfully requests withdrawal of the rejection to the claims under 35 USC §103(a).

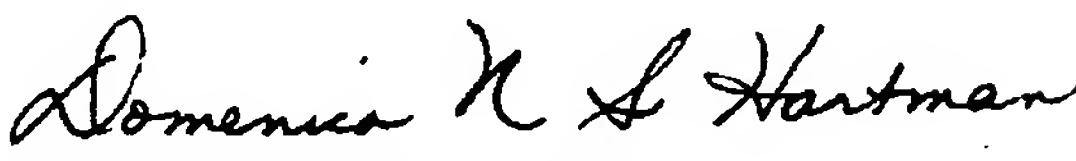
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Closing

In view of the above, Applicant believes that the claims define patentable novelty over all the references, alone or in combination, of record, and respectfully requests that his patent application be given favorable reconsideration.

Should the Examiner have any questions with respect to any matter now of record, Applicant's representative may be reached at (219) 462-4999.

Respectfully submitted,

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January 6, 2005
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